OBSERVATIONS ON THE BREEDING OF MAJOR CARPS IN A DRY BUNDH OF UTTAR PRADESH DURING 1976 MONSOON SEASON[1]

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(*With a text-figure*)

Introduction

For production of fish seed, bundh breeding has been a popular method in Bengal and Madhya Pradesh for the last several years. While in West Bengal it is practised by private fish farmers, most of the dry bundhs of Madhya Pradesh are managed and operated by the State Fisheries Department. Breeding of major carps is carried out in dry bundhs on a large scale in the Bankura and Midnapore districts of West Bengal, giving no particular attention to details relating to the number of breeders per unit area of a bundh, the ratio of male and female breeders, size compatibility or the condition of their gonads (Dubey 1969). In these bundhs, the breeding of major carps is induced by artificially flooding them and thereby creating fluviatile conditions. However, in the Bankura district a few of the brood fishes are invariably administered pituitary hormone injections, taking no cognizance of the ratio between the numbers of injected and uninjected fishes to generate sympathetic breeding response among the rest of them. The bundh breeding technique adopted in Sonar Tallaiya (Dist. Chhatarpur) in Madhya Pradesh in the year 1958, however, makes a departure from the usual practice in that it makes no provision for outflow of water at the time of breeding (Dubey and Tuli 1961 and Dubey *et al.* 1968).

In the present communication are given the results of experiments on the bundh breeding of major carps which were conducted at the Ganne dry bundh of Uttar Pradesh near Allahabad during the 1976 monsoon season.

Description of Ganne dry bundh:

Ganne dry bundh is located at a distance of 45 km from Allahabad near Ganne village in Tahsil Karchna of Allahabad district (25°N, 81°71'E) on Allahabad-Rewa Road (Fig. 1).

It was constructed by the U.P. Fisheries Department in the year 1971 by putting an earthen dam wall, across the 'run-off' from the catchment area, with masonry structure of waste weir and sluice gate in the centre of the dam wall. The waste weir is provided with a set of screens made of expanded metal, along its entire length to permit over-flow of water and prevent the escape of breeders from the bundh whereas provision is made to guard the sluice gate by two types of screens, one made of expanded metal for preventing the escape of breeders, when the sluice gate is opened to maintain the water current within the bundh and the other fine meshed one which is fitted after breeding for preventing the loss of fertilized eggs.

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The bed of the bundh is studded with boulders at several places. The bundh has a gradually sloping catchment area of 1.6 square km which is mostly rocky and with laterite soil. The entire catchment area is covered with *Dhak* plants and small bushes. A small rivulet provides an inlet to the bundh on its western side. The water from waste-weir and sluice gate flows through an outlet into a nalah on the eastern side of the bundh.

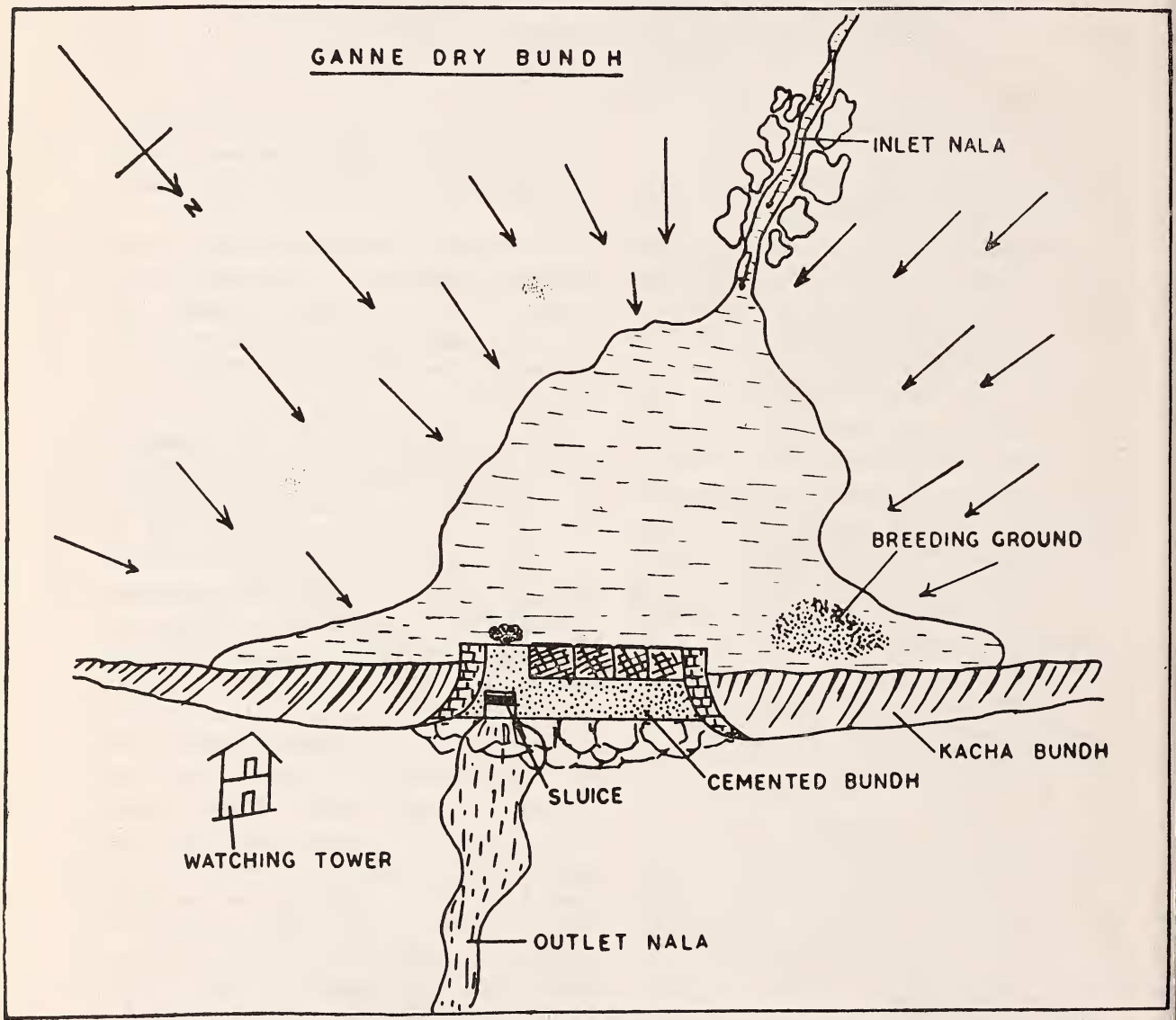

Fig. 1. Sketch of Ganne dry bundh.

Material and methods

For conducting breeding experiments in Ganne dry bundh, in all 39 breeders of *Labeo rohita* (Ham.) and *Cirrhinus mrigala* (Ham.) with ripe gonads in prime condition were procured from the Tendua Fish Farm of Uttar Pradesh Fisheries Department and transported in Plastic Pools fitted in a Jeep Trailer, covering a distance of 85 km. When sufficient rain water draining about one square mile of catchment area was impounded in the dry bundh, 18 breeders of *Labeo rohita* and 21 of *Cirrhinus mrigala* were introduced in two batches on 3rd and 12th August 1976. The breeders which were experimented with had the following length and weight ranges, and sex ratio (Table 1).

Table 1

Species	Length range (mm)	Weight range (gm)	Sex ratio (by number)
L. rohita	235-420	150-700	1 M : 1 F
C. mrigala	240-440	200-1200	2 M : 1 F

Prior to introducing the breeders into the bundh, male and female were kept segregated in Tendua Fish Farm, as has been recommended by several fishery scientists. In the absence of stocking ponds at bundh site, different sex ratios could not be attempted nor was it possible to attempt successive breeding experiments.

Proper screening of breeders in respect of state of gonads was done before introducing them into the bundh. The males were selected initially on the basis of roughness of pectoral fins and operculum and oozing of milt on slight pressure on the abdomen. For the selection of ripe gravid females, the characters like bulging, soft abdomen and swollen vent were taken into consideration. The extrusion of eggs with slight pressure on abdomen was taken as sure test for ripeness of the ovary.

The initial objective of experiments on bundh breeding was to elucidate meteorological, physico-chemical, and biological factors specific to breeding. With failure of breeders of first batch introduced in the bundh on 3rd August 1976 to respond to breeding due to drought conditions prevailing until 11th August 1976, one set (2M:1F) each of rohu and mrigal, out of second lot of breeders, was administered with pituitary hormone injection and released along with remaining uninjected breeders in the bundh on 12th August 1976 with a view to evoking sympathetic breeding and determining the optimum ratio between injected and uninjected breeders.

With the conclusion of experiments, the breeders were netted out from the bundh and were examined externally to ascertain the number of breeders that had bred.

During the entire period of investigations, observations with regard to meteorological and physico-chemical conditions and fluctuations on water level in the bundh were made.

Observations and results

After the accumulation of rain water in the bundh resulting from initial rains in the last week of June and subsequent erratic rains in the following month, the first batch of breeders was released on 3rd August 1976. While negligible rains were experienced during the entire month of July and early part of the following month, a heavy downpour was recorded in the night between 11th and 12th August 1976, thereby raising the water level consider-

ably within the bundh. The downpour and the resultant influx of water into the bundh hardly evoked any breeding among the breeders stocked on 3rd August 1976 and moreover the number of breeders in the bundh had dwindled as a result of periodical mortality between 3rd and 11th August 1976 evidently due to rise in water temperature in the bundh. Due to this exigency, the second batch of breeders was procured in the late afternoon of 12th August 1976. Since the normal breeding conditions did not prevail and the resorption of the gonads was feared, one set (2M:1F) each of rohu and mrigal, out of the second batch, was given pituitary hormone injection prior to their being released into the bundh along with other breeders of the lot in order to facilitate sympathetic breeding among the remaining uninjected breeders. After a few hours of releasing the second lot of breeders including a sub-set of injected ones, a heavy downpour was experienced and a congregation of fish was noticed in the evening on the north-west bank of the bundh, about 50 feet from the waste weir. Within the following few hours, the accumulated rain water covered a large peripheral area of the bundh, raising the water level within the bundh considerably. At this stage, the sluice gate was fully opened to permit outflow of excess water. This was mainly done for two reasons—firstly, to maintain water current within the bundh as this factor is said to be conducive for breeding and secondly, to obviate breach in the earthen bundh as it was feared that accumulated water within the bundh may exert pressure on the bundh resulting in breach of bundh as was observed to happen during 1975 monsoon season. The breeders were seen moving about actively in the shallow regions where the water depth was less than one metre. A constant vigil was kept from the observation tower throughout the night, when sex play was observed to be in progress, and the breeding took place sometime in the early hours of 13th August 1976 and also on 14th August 1976 near the north-west bank of the bundh where a mild water current was observed. A fairly strong water current main-

TABLE 2

PHYSICO-CHEMICAL CONDITIONS OF BUNDH WATER RELATING TO PRE-, DURING AND POST BREEDING PERIODS

Physico-Chemical Factors	Pre-Breeding period	Breeding Period	Post-Breeding Period
Air Temperature °C	26.0 — 31.0	26.8	27.0 — 30.0
Water Temperature °C	26.8 — 31.8	27.4 — 28.0	28.0 — 31.0
Dissolved Oxygen (ppm) d.o.	6.2 — 8.2	5.6 — 7.6	6.0 — 7.0
Free CO_2 (ppm)	1.0 — 4.0	2.0 — 12.0	1.0 — 6.0
pH	7.8 — 8.0	7.6	7.6 — 8.0
Hardness (ppm)	18.0 — 22.0	16.0 — 22.0	18.0 — 20.0
Total Alkalinity as $CaCO_3$ (ppm)	36.0 — 50.0	28.0 — 32.0	30.0 — 34.0
Calcium (ppm)	24.0 — 36.0	24.0	22.0 — 24.0
Silicate (ppm)	8.0 — 10.0	8.0	8.0
Phosphate (ppm)	0.01	0.01	0.01
Organic Carbon (ppm)	8.8 — 10.2	6.8 — 8.0	5.8 — 7.0
Transparency (cm)	10.6 — 21.0	10.6 — 12.0	8.0 — 12.0

tained by outgoing water was, however, observed near the waste weir and fertilized eggs in lakhs were seen being washed away from the spawning ground and escaping through sluice gate along with gushing waters. The attempt at collecting the fertilised eggs with a piece of mosquito netting cloth by filtering gushing water at the other side of the sluice gate was not successful as majority of them got ruptured in the process of collection in this manner. The fertilised eggs at the spawning ground were allowed to remain undisturbed for about 8 hours, in order to obviate the rupture of egg shells and consequent damage of developing embryos. The eggs subsequently collected from the spawning ground were hatched in double walled hatching *hapas* fixed in the bundh itself. The hatchlings on rearing were found to be mostly of mrigal (70%) and few of them belonged to rohu (30%).

On the breeding day, the air and water temperature were 26.8°C and 27.7°C respectively, pH (7.6), D.O (5.6-7.6 ppm) and total alkalinity (28-32 ppm) was relatively low, while value of free CO_2 was high (12.0 ppm). The high values of free CO_2 reflects the absence of carbonate content of water. The details of physico-chemical features relating to pre-, during and post breeding periods are shown in Table 2.

Discussion

The year 1976 was marked by erratic monsoons, and drought conditions prevailed until 11th August. Though the first batch of breeders with ripe gonads in prime condition was stocked in Ganne dry bundh on 3rd August after the accumulation of sufficient water in it the breeding among them was not induced upto 11th August due to lack of heavy flooding of the bundh and other associated conditions. Khan (1924) and Ganapati and Chacko (1954) observed that flooding in the early phase of south-west monsoons is necessary and the fish do not spawn if the rains are delayed. Khanna (1958) reported that during the course of his observations the fish did not breed during the years when the floods were insufficient and untimely. Bhimachar and Tripathi (1967) stated that the breeding among major carps is induced by suitable meteorological conditions during monsoon period. Further they stated that the breeding season of major carps is short and the optimum weather conditions are limited to a few days during this (monsoon) period and as such the scope of induced breeding is very much restricted, even when a good stock of breeders is available.

The heavy monsoon showers in the catchment area of Ganne dry bundh resulting in heavy flooding of the bundh was experienced in the night of 11th/12th August, which amply provided favourable conditions for the breeding of major carps in the bundh. Since the resorption of the gonads of major carps is generally believed to commence by mid August, it was considered that the breeders were not in a condition to respond to suitable environmental conditions prevailing then, fearing that their gonads were already on way to resorption. Therefore amongst the second batch of breeders which were obtained on 12th August 1976 for stocking the dry bundh, one set each of rohu and mrigal (2M : 1F) were administered pituitary hormone injection in order to induce sympathetic breeding among the rest including the breeders stocked on 3rd August 1976. It is significant to record that the breeding in 18 sets of uninjected breeders was stimulated by one set of injected breeders of the two species of fish, ratio between injected and uninjected breeders being 1:9. It would lead to valuable information if further

such experiments are conducted to determine the extent to which optimum ratio between the two could be increased, as this would help saving pituitary gland injection when sympathetic breeding may have to be resorted to on occasions when breeding in dry bundhs does not normally come off due to drought conditions which may happen during monsoons.

Ranganathan *et al.* (1967) reported for the first time successful sympathetic spawning of major carps in cement cistern. Choudary (1968) reported on the indirect inducement of fish breeding in barren bundh-type fishery by selective induced breeding. Mitra (1974) has given observations of an experiment conducted for the purpose of inducing breeding of uninjected breeders kept together with pituitary injected ones in the same confinement. In these instances of sympathetic breeding in cisterns or other confined waters, no account of environmental conditions including physico-chemical factors has been given. While discussing the factors responsible for the breeding of major carps in rivers, reservoirs, ponds etc., Hora (1945), Hussain (1945), Khan (1945), Mookerjee (1945), Chaudhuri (1969) and Ray *et al.* (1969) have considered fresh rain water, flood water, water current, shallow inundated areas and physico-chemical conditions of water, such as turbidity, temperature, pH, dissolved oxygen content, hardness, carbonates, bicarbonates, chlorides etc. as important ecological inducements for natural spawning of Indian major carps. Of these, fresh rain water and flooded condition appear to provide primary stimuli to spawning and sex play, finally resulting in spawning (Singh 1969).

During investigations at Ganne dry bundh, rohu and mrigal breeders were released on 3rd August 76 in the bundh containing rain water accumulated during earlier showers in June, but they did not breed evidently because there were no heavy showers during the period between 3rd and 11th August, 1976 to cause further accumulation of rain water creating flooded conditions within the bundh and also lowering of atmosphere and water temperature—so essential for providing stimulus for breeding (Dubey *et al.* 1968, Chaudhuri 1969, Gupta 1908, Mookerjee *et al.* 1944, Hora 1945, Ganapati *et al.* 1947, Bhimachar & Tripathi 1967 and Selvaraj *et al.* 1971). However, heavy showers in the vicinity of the bundh and resultant on-rush of water in the bundh were experienced on the night of 11th/12th August, 1976, and following two days. With the introduction of one set each of injected rohu and mrigal breeders (2♂:1♀) in the evening of 12th August, 1976 in the bundh, the breeding in the uninjected breeders was induced successfully in the early hours of 13th and 14th August, 1976. This was primarily attributed to heavy showers adding rain water in sufficient quantity in the bundh creating flood-like conditions, and providing moderate water at the spawning ground (De 1910, Khan 1924, Hora 1945, Kussain 1945, Khanna 1958, and Anand 1973). The other factors which were probably conducive to sympathetic breeding in the present case appear to be lower pH (Ganapati and Chacko 1954, Khanna 1958 and Selvaraj *et al.* 1971), lower oxygen content of water (Khan 1924, Alikunhi 1951 and Khanna 1958), lower values of total alkalinity (Saha *et al.* 1957 and Selvaraj *et al.* 1971) and high free carbon dioxide (Selvaraj *et al.* 1971).

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